UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF CHEMICAL SAFETY AND POLLUTION PREVENTION

MEMORANDUM

DATE: 05-DEC-2019

SUBJECT: **TCVP:** Review and Summary of Residue Transfer Studies Submitted

PC Code: 083701, 083702
Decision No.: 552915
Petition No.: N/A
Risk Assessment Type: N/A
TXR No.: N/A
MRID No.: 50719201, 50719202, 50881801, 50881802

DP Barcode: D453149
Registration No.: N/A
Regulatory Action: Registration Review
Case No.: 321
CAS No.: 961-11-5, 22248-79-9
40 CFR: N/A

FROM: Kelly Lowe, Environmental Scientist
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THROUGH: Michael S. Metzger, Chief
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TO: Patricia Biggio, Chemical Review Manager
Pesticide Reevaluation Division (7508P)

ACTION REQUESTED:

PRD requested that HED conduct a review of several pet collar residue transfer studies submitted by Hartz Mountain Corporation for tetrachlorvinphos (TCVP). These studies measure the relative fractions of TCVP and the plasticizing agent, diisooctyl adipate (DCA), and movement of these residues exuding from the collar and spreading across the animal's body using a variety of study methods. The studies include the following: 1) a wipe and weigh of the collar following placement on dogs with subsequent fur clipping and collar analysis, 2) fur clippings over 3 days following collar placement with subsequent collar analysis, and 3) a study of residue transfer following contact with a gloved hand. These data were determined to be acceptable for use in risk assessment.

SUMMARY OF STUDY RESULTS:

MRID 50719201: "*Determination of Available Transferable Residue of TCVP and DCA Onto Pet Hair During Normal Use*"

The registrant provided this study to evaluate the available transferable residues and physical state of the active ingredients, TCVP and DCA, during normal use of the Hartz Ultra Guard Flea and Tick Collar for Dogs (EPA Reg. No. 2596-84). In Phase I, TCVP and DCA residues were measured on dog hair and on the surface of the collar after collar activation on days 1 through 3 (hair and collar surface sampling). Hair was also sampled on days 7, 14 and 21. In Phase II, TCVP and DCA residues were measured on a second set of test animals (neck, back, tail) for three days after collar activation. During this phase, gloved mannequin hand petting simulations were also used to collect residues three days after collar placement on a subset of dogs.

In Phase I, 18 dogs (6 groups of 3 dogs) were treated with TCVP pet collars; in Phase II, 9 dogs (3 groups of 3 dogs) were treated. Collars were removed from packaging, unrolled and stretched before being placed on the dog's neck. The full collar weight was recorded prior to placement, and the cut off excess collar weight was taken after placement to get the initial weight of the collar.

Wipe Sampling: Wipe sampling was completed for Phase I, Groups 1, 2, and 3. A 3" by 3" wipe was folded around the collar and wiped along the entire collar. The process was repeated in the opposite direction with a second wipe. The wipes were then folded and placed in a 2 oz. bottle, sealed and shipped.

Fur Collection: Hair samples were collected (approximate 2 gram samples) from 6 test groups on days 1 (group 1), 2 (group 2), 3 (group 3), 7 (group 4), 14 (group 5), and 21 (group 6). The hair was clipped from the dorsal area of the neck from where the collar came into contact with the dog (Phase I, groups 1 through 6), midline, and base of tail (Phase I, groups 4 through 6; Phase II, groups 1 through 3). The clipped hair sample was placed in a pre-tared 2 oz bottle for shipment and analysis by gas chromatography.

Collar Sampling: Separately, once the collars had been sampled and/or removed, they were placed into a tared 4 oz jar, weighed, sealed and shipped for analysis.

Petting: In Phase II, group 3 dogs were stroked with 30 petting simulations meant to mimic normal petting actions (each petting simulation consisting of 3 strokes from the head and ending at the tail- right side, left side and back line, resulting in 90 strokes) with a mannequin hand sampler that had two cotton gloves over a polyethylene glove and was held by an individual. The person holding the mannequin hand was the same individual for all dogs/simulations. After petting simulations, individual gloves were removed and placed in separate containers and shipped for analysis.

Summary of Results:
The hair, wipe, and collar samples were analyzed and results were presented for the amount of TCVP and DCA. Additionally, the ratio of TCVP to DCA was presented for hair and wipe

samples. For the petting simulation study, results were presented for the amount of TCVP; the amount of DCA was not analyzed.

Wipe Samples: DCA and TCVP were present together in all wipe samples (taken during Phase I on Days 1 through 3 only). In wipe samples, the range of ratios of TCVP to DCA were: 12 to 66X (Day 1); 12 to 31X (Day 2); 24 to 50X (Day 3).

Hair Samples: In Phase I, DCA and TCVP were present together in all hair samples. The range of ratios of TCVP to DCA from neck fur were: 4.0 to 24X (Day 1); 8.9 to 12X (Day 2); 8.4 to 13X (Day 3); 1.8 to 6.0X (Day 7); 0.8 to 3.4X (Day 14); 0.7 to 5.8X (Day 21). Table 1 presents the summary results (as taken from the report). In Phase II, DCA and TCVP were also present together in all neck hair samples; however, there were several back or tail samples where TCVP was present and DCA was not detected. Tables 2 through 4 highlight those instances (as taken from the report). Note: Hair samples appear to have been taken prior to the Day 3 petting simulations.

Collar Samples: The initial and final weights were presented, along with the percentage of TCVP and DCA. The collar initial analysis resulted in 15% TCVP and 27% DCA. For Phase I and II, the final percentage TCVP ranged from 7.0% to 13% and the % DCA ranged from 24% to 29%.

Petting Simulations: TCVP was detected on all cotton gloves used in the simulation. The range of TCVP for the outer cotton glove ranged from 2,800 µg to 3,800 µg and for the inner glove ranged from 53 µg to 170 µg. The amount of DCA was not analyzed following the petting simulations.

Results from the study are provided below in Tables 1-4 (tables copied directly from report).

Table 1. Phase I Summary Results for Hair

Group #	Day	Animal #	Sample ID	Sample Weight (gr)	HAIR TCVP (ng)	HAIR DCA (ng)	RATIO TCVP/DCA	Average RATIO TCVP/DCA	%TCVP IN Hair	Average %TCVP IN Hair	%DCA IN Hair	Average %DCA IN Hair
1	1	MC2858-N	Hair	1.63	18280.4	631.2	24.2		0.94		0.04	
1	1	MC9124-N	Hair	2.80	29347.1	3011.6	9.7	12.6	1.05	0.89	0.11	0.11
1	1	MC8799-N	Hair	1.54	10631.2	2626.8	4.0		0.69		0.17	
2	2	520-N	Hair	2.55	48519.5	3968.8	12.2		1.90		0.16	
2	2	MC4122-N	Hair	1.31	14996.0	1687.2	8.9	10.9	1.14	1.32	0.13	0.12
2	2	MC3337-N	Hair	2.04	18566.6	1598.5	11.6		0.91		0.08	
3	3	F0088-N	Hair	3.06	35128.1	2864.2	12.3		1.72		0.09	
3	3	MC1368-N	Hair	1.82	22828.4	2703.2	8.4	11.3	1.25	1.04	0.15	0.12
3	3	MC0512-N	Hair	2.31	3187.7	243.0	13.1		0.14		0	
4	7	MC1576-T	Hair	1.85	520.4	72.6	7.2		0.03		0	
4	7	MC1576-N	Hair	1.57	12954.0	2171.6	6.0	6.0	0.83	0.32	0.14	0.05
4	7	MC1576-B	Hair	2.10	2202.0	211.6	10.4		0.10		0.10	
4	7	MC3616-T	Hair	3.15	1048.6	323.6	3.2		0.03		0.01	
4	7	MC3616-N	Hair	1.04	10529.2	5908.4	1.8	1.8	1.01	0.37	0.57	0.20
4	7	MC3616-B	Hair	1.97	709.6	250.1	2.8		0.06		0.01	
4	7	MC4078-T	Hair	1.83	693.6	102.7	6.8		0.04		0	
4	7	MC4078-N	Hair	2.53	26987.7	4882.4	5.5	5.5	1.07	0.04	0.19	0.06
4	7	MC4078-B	Hair	2.03	1806.2	277.0	6.5		0.09		0.01	
5	14	MC2927-T	Hair	3.99	309.5	442.7	0.7		0		0.01	
5	14	MC2927-N	Hair	2.74	2122.0	882.9	2.4	1.3	0.07	0.03	0.03	0
5	14	MC2927-B	Hair	2.87	441.8	644.5	0.7		0		0.02	
5	14	MC9742-T	Hair	2.84	234.7	220.0	1.1		0		0	
5	14	MC9742-N	Hair	2.40	5770.0	7664.9	0.8	1.0	0.24	0.08	0.32	0.12
5	14	MC9742-B	Hair	3.65	200.8	176.8	1.1		0		0	
5	14	MC3374-T	Hair	2.62	187.2	109.2	1.7		0		0	
5	14	MC3374-N	Hair	4.61	27798.0	8008.0	3.5	2.6	0.60	0.02	0.17	0.06
5	14	MC3374-B	Hair	3.27	291.0	117.7	2.5		0		0	
6	21	MC7305-T	Hair	3.47	182.7	119.3	1.5		0		0	
6	21	MC7305-N	Hair	3.87	21652.4	9087.9	2.4	2.0	0.56	0.23	0.23	0.08
6	21	MC7305-B	Hair	2.71	386.2	184.6	2.1		0.14		0	
6	21	MC6654-T	Hair	2.70	186.2	342.7	0.5		0		0	
6	21	MC6654-N	Hair	3.30	7759.4	10288.4	0.7	0.7	0.24	0.08	0.31	0.11
6	21	MC6654-B	Hair	3.08	433.4	553.5	0.8		0.01		0.02	
6	21	MC0008-T	Hair	2.68	72.5	33.3	2.2		0		0	
6	21	MC0008-N	Hair	2.61	23583.8	4054.3	5.8	4.2	0.90	0.03	0.04	0
6	21	MC0008-B	Hair	2.87	343.6	74.1	4.6		0		0	

Table 2. Phase II, Hair Residues, Day 1

Day 1: 11/28/17

#	Group #	Animal #	Sample ID	Hair location	Sample Weight (gr)	HAIR TCVP (µg)	HAIR DCA (µg)	RATIO TCVP/DCA
1	1	MC2817	Hair Placebo	---	2.10	ND	ND	---
2	1	MC3925	Hair Placebo	---	2.08	ND	ND	---
3	1	MC3605	Hair Placebo	---	2.02	ND	ND	---
4	1	MC2817	Hair	TAIL	2.03	ND	ND	---
5	1	MC2817	Hair	NECK	4.59 !!	54011.2	3006.1	18.0
6	1	MC2817	Hair	BACK	2.16	588.8	35.9	16.4
7	1	MC3925	Hair	TAIL	2.00	ND	ND	---
8	1	MC3925	Hair	NECK	1.77	15356.1	1504.8	10.2
9	1	MC3925	Hair	BACK	2.05	309.5	27.2	11.4
10	1	MC3605	Hair	TAIL	2.01	ND	ND	---
11	1	MC3605	Hair	NECK	2.14	10517.5	1045.0	10.1
12	1	MC3605	Hair	BACK	2.19	143.7	14.9	9.6

Table 3. Phase II, Hair Residues, Day 2

Day 2: 11/29/17

#	Group #	Animal #	Sample ID	Hair location	Sample Weight (gr)	HAIR TCVP (µg)	HAIR DCA (µg)	RATIO TCVP/DCA
1	2	MC0585	Hair Placebo	----	2.00	ND	ND	----
2	2	MC7045	Hair Placebo	----	2.00	ND	ND	----
3	2	MC8252	Hair Placebo	----	2.08	ND	ND	----
4	2	MC0585	Hair	TAIL	2.01	129.5	ND	----
5	2	MC0585	Hair	NECK	2.59	43212.1	2573.5	16.8
6	2	MC0585	Hair	BACK	2.05	222.7	ND	----
7	2	MC7045	Hair	TAIL	2.06	120.6	ND	----
8	2	MC7045	Hair	NECK	2.86	25030.3	1869.7	13.4
9	2	MC7045	Hair	BACK	2.02	183.8	ND	----
10	2	MC8252	Hair	TAIL	2.18	75.4	ND	----
11	2	MC8252	Hair	NECK	3.62	74484.1	5603.8	13.3
12	2	MC8252	Hair	BACK	2.03	444.5	34.7	12.8

*highlighted values represent samples were TCVP was measured but DCA was non-detect

Table 4. Phase II, Hair Residues, Day 3

Day 3: 11/30/17

#	Group #	Animal #	Sample ID	Hair location	Sample Weight (gr)	HAIR TCVP (µg)	HAIR DCA (µg)	RATIO TCVP/DCA
1	3	MC1488	Hair Placebo	----	2.01	ND	ND	----
2	3	MC4647	Hair Placebo	----	2.05	ND	ND	----
3	3	MC5728	Hair Placebo	----	2.00	ND	ND	----
4	3	MC1488	Hair	TAIL	2.05	140.2	ND	----
5	3	MC1488	Hair	NECK	2.68	30260.1	2282.1	13.3
6	3	MC1488	Hair	BACK	2.09	432.4	32.5	13.3
7	3	MC4647	Hair	TAIL	2.07	143.9	21.6	6.7
8	3	MC4647	Hair	NECK	2.81	10342.6	1407.8	7.3
9	3	MC4647	Hair	BACK	2.03	332.8	34.0	9.8
10	3	MC5728	Hair	TAIL	2.04	95.9	ND	----
11	3	MC5728	Hair	NECK	1.85	22269.3	2413.5	9.2
12	3	MC5728	Hair	BACK	2.06	469.2	43.9	10.7

*highlighted values represent samples were TCVP was measured but DCA was non-detect

MRID 50719202: "*Movement and Measurement of Available Residues of TCVP and DCA Onto Pet Hair During Normal Use – 3 days*"

The intent of this study was for determination of form (solid vs liquid) by calculation of the ratio of measured TCVP to DCA. The submitted data evaluated the spread of TCVP and DCA over treated dogs and measured the relative fractions of these ingredients over the course of three days. Eighteen dogs were treated with TCVP pet collars in 6 groups of 3 dogs each. Fur was

collected (1 to 2 gram samples) from 2 test groups daily. The fur was clipped from 1) the dorsal area of the neck, from where the collar came into contact with the dog, 2) along the midline (dorsal area) of the dog, halfway between the shoulder blades and the base of the tail, and 3) along the midline of the dog, at the base of the tail. The clipped fur sample was weighed and then placed in a separate pre-tared 2 oz bottle for shipment and analysis. Separately, once the collars had been sampled/removed, they were placed into a 4 oz jar, sealed and shipped for analysis.

Results from the fur clipping were presented for each of the three fur clippings for each dog sampled on Days 1 through 3. The movement and measurement of TCVP and DCA pet fur residues and relative ratios is summarized in Table 5. Movement of residues was measured as early as the day following product application (Day 1). The majority of TCVP and DCA residue for all 3 days were measured at the neck, as is expected since the neck is the application site, followed by the back area. Detectable residues of DCA on the tail were measured only on Day 3. Where both TCVP and DCA residues were measured on an area of a sampled animal, TCVP/DCA residue ratios residues ranged from 12.8 – 13.8X on Day 1; 17.4 – 18.2X on Day 2; and 5.6 – 8.8X on Day 3.

The fur clipping results indicate the movement of TCVP and DCA across the dog's bodies from the application site (neck) over Days 1 through 3. Further, for most of the neck and back samples collected, TCVP measures are typically accompanied by DCA residues; most tail samples result in TCVP residues only with DCA present only on Day 3.

Table 5. Summary of Movement and Measurement of TCVP and DCA (ug) Pet Fur Residues and Relative Ratios

Day 1									
	Neck			Back			Tail		
	TCVP	DCA	Ratio	TCVP	DCA	Ratio	TCVP	DCA	Ratio
MC0218	31211.8	1956.4	15.9	473.4	29.8	15.9	71.3	ND	N/A
MC1630	24952.7	1634.9	16.2	456.8	28.2		111.8	ND	N/A
MC3381	41594.4	3874.1	10.9	383.5	35		41.4	ND	N/A
MC5715	19876.5	1522.2	13	225.3	20.5	11	94.5	ND	N/A
MC6691	59667.4	4513.7	13.2	702.5	56.8	12.4	58.7	ND	N/A
MC7350	14065.5	1031.2	13.6	281.9	23.8	11.8	249.7	ND	N/A
Average	31894.7	2422.1	13.8	420.6	32.7	12.8	104.6	N/A	N/A
Day 2									
	Neck			Back			Tail		
	TCVP	DCA	Ratio	TCVP	DCA	Ratio	TCVP	DCA	Ratio
MC0263	48461	2388.8	20.3	536.1	29.3	18.3	176.4	ND	N/A
MC2888	56590.5	5751.5	9.8	516.9	49.3	10.5	95.1	ND	N/A
MC3089	7621.8	376	20.3	263.8	ND	N/A	165.4	ND	N/A
MC3659	51335.5	3194	16.1	529.8	30.1	17.6	136.9	ND	N/A
MC9596	80136.5	3458.3	23.2	933.4	35.2	26.5	203.7	ND	N/A
F0165	13696.7	933.8	14.7	78	ND	N/A	226.2	ND	N/A
Average	42973.7	2683.7	17.4	476.3	31.5	18.2	167.3	N/A	N/A
Day 3									
	Neck			Back			Tail		
	TCVP	DCA	Ratio	TCVP	DCA	Ratio	TCVP	DCA	Ratio
MC0415	41254.2	5484	7.5	907.5	113.2	8	192	34.9	5.5
MC0782	35731.7	6222.5	5.7	469.2	86.7	5.4	211.4	32.9	6.4

Table 5. Summary of Movement and Measurement of TCVP and DCA (ug) Pet Fur Residues and Relative Ratios									
Day 1									
MC3537	61924.1	6564.2	9.4	735.5	94.6	7.8	277.4	43	6.5
MC5059	10921	3258.7	3.4	1259.9	222.4	5.7	480.9	125.9	3.8
MC7286	67077.2	3298.1	20.3	598.8	33.8	17.7	230.5	72.6	3.2
MC9245	30350.8	5687.5	5.3	764.8	95.3	8	324.1	39.1	8.3
Average	41209.8	5085.8	8.6	789.3	116.2	8.8	286.1	58.1	5.6

*highlighted values represent samples were TCVP was measured but DCA was non-detect

MRIDs 50881801; 50881802: "*Determination of transferable residues of TCVP and DCA released onto cotton gloves from petting simulations – Final Report*"

The purpose of the study was to measure the transferability of the test substance, TCVP, and DCA from the hair of a dog wearing a TCVP-impregnated collar. Each collar contained 14.55% TCVP (wt/wt). The collars are typically applied to dogs by securing the collar around the dog's neck and cutting off any excess collar length.

A total of 9 dogs were used in the study, randomly assigned to 3 groups. Each group had different assigned number of simulations. Dogs in Group 1 were petted for 5 simulations, dogs in Group 2 received 10 petting simulations, and dogs in Group 3 received 25 petting simulations. Each simulation consisted of three strokes conducted using a mannequin hand fitted with three cotton gloves. The first stroke was on the right side, the second on the left side, and the third was along the back line. After the simulations, all 3 gloves were removed and placed individually into labeled jars. Samples were collected from each dog 4 days prior to application of the collar (4 days prior to treatment or -4DAT) and 10 days after application of the collar (10DAT). In addition, at the end of the study, each collar used on the animals was collected, stored in separate containers, and sent to the analytical testing laboratory facility.

Fortification samples were prepared on -4DAT and 10DAT. Duplicate samples were fortified with each analyte at three levels: 120 µg/sample (LOQ), 2,000 µg/sample, and 4,400 µg/sample. Fortified samples were handled, stored and shipped in the same manner as the residue samples. Average recoveries for the low-, mid- and high-level fortified samples ranged from 87.3 – 114% for TCVP on sampling day 10 and from 82.5-105% for DCA.

Glove samples collected prior to the application (-4DAT) did not have any detectable residues and are not discussed herein. The 10-DAT field samples were corrected using the 10-DAT field fortification recoveries. Residues ≤660 µg were corrected for the average low level field fortification recovery (87.3% for TCVP and 82.5% for DCA); residues >2,800 µg were corrected for the average high level field fortification recovery (106% for TCVP and 100% for DCA); and residues between 600 µg and 2,800 µg were corrected for the average mid-level field fortification recovery (114% for TCVP and 105% for DCA). Residues were calculated in µg/glove, µg/cm^2 of dog surface area, percent of initial TCVP in collar, and percent of applied dose transferred.

The difference between the initial collar weight and the end weight was multiplied by the percent active ingredient in the collar (14.55% TCVP) to calculate the actual dose applied. The actual dose applied ranged from 0.052 to 0.269 g ai (average of 0.123 g). In addition, the initial TCVP

in the collar was calculated by multiplying the percent active ingredient in the collar (14.55%) by the initial weight of the collar. The initial TCVP in the collar ranged from 2.52 to 3.05 g ai (average of 2.81 g).

The highest average residues of TCVP occurred on gloves after 20 petting simulations (Group 3) at 4,527.5 µg/gloves (5.98% of applied dose and 0.886 µg/cm^2). The lowest average residues of TCVP were observed on gloves from Group 2 (10 petting simulations) at 2,512.9 µg/gloves (1.53% of applied dose and 0.456 µg/cm^2). For DCA, average residues were highest on gloves from Group 3 (20 petting simulations) at 473.9 µg/gloves. The relative ratio of TCVP/DCA ranged from 7.0 to 14.5; the highest average ratio was observed in Group 2 at 12.9.

Percent transferable residues of TCVP is calculated by taking the ratio of the residues of TCVP observed on the glove to the total amount of TCVP in the collar at application (calculated as the percent TCVP * initial weight of collar). This results in percent transfer values ranging from 0.049% to 0.228%. The average percent transferable residues of TCVP were 0.098% for Group 1 (5 petting simulations), 0.086% for Group 2 (10 petting simulations), and 0.167% for Group 3 (25 petting simulations).

No major issues were identified during review of this study and the results are considered acceptable for risk assessment purposes. A detailed review of this study was conducted and is presented in Appendix A.

Appendix A. Detailed Review of MRIDs 50881801; 50881802: "*Determination of transferable residues of TCVP and DCA released onto cotton gloves from petting simulations – Final Report*"

STUDY TYPE: Transferable Residues after Petting Simulations to Animal Hair

TEST MATERIAL: The test material was a TCVP-impregnated collar, referred to as Hartz® Ultra Guard Flea and Tick Collar for Dogs. The collar contains a nominal 14.55% (wt/wt) TCVP.

SYNONYMS: TCVP; Tetrachlorvinphos

CITATION:

Study Author:	William Russell Everett (Study Director)
Title:	Volume 1 - Determination of transferable residues of TCVP and DCA released onto cotton gloves from petting simulations; Final Report (MRID 50881801)
Report Date:	June 4, 2019
Study Author:	J. Conti; K. Goldman; S. Hatzikyrakou; J. Driver; J. Ross; and N. Driver.
Title:	Volume 2 - Determination of Transferable Residues of TCVP and DCA Obtained by Cotton Glove etting Stokes from the Hair Coat of Dogs Following Pet Collar Use (MRID 50881802)
Report Date:	June 4, 2019
Performing Laboratories:	*In-life phase*: BerTek, Inc. 104 Wilson Bottom Road P.O. Box 606 Greenbrier, AR 72058 *Analytical phase*: Hartz Technical Center The Hartz Mountain Corporation 400 Plaza Drive Secaucus, New Jersey 07094
Identifying Codes:	Sponsor Study 2911; BerTek Study 107-057.

SPONSORS: The Hartz Mountain Corporation
400 Plaza Drive
Secaucus, New Jersey 07094

EXECUTIVE SUMMARY:

The purpose of the study was to measure the transferability of the test substance (TCVP) and a plasticizing agent [1, hexanedioic acid, bis (1-methylheptyl) ester or DCA] from the hair of a dog wearing a TCVP-impregnated collar. Each collar contained 14.55% TCVP (wt/wt). The collars are typically applied to dogs by securing the collar around the dog's neck and cutting off any excess collar length.

A total of 9 dogs were used in the study, randomly assigned to 3 groups. Each group had different assigned number of simulations. Dogs in Group 1 were petted for 5 simulations, dogs in Group 2 received 10 petting simulations, and dogs in Group 3 received 25 petting simulations. Each simulation consisted of three strokes conducted using a mannequin hand fitted with three cotton gloves. The first stroke was on the right side, the second on the left side, and the third was along the back line. After the simulations, all 3 gloves were removed and placed individually into labeled jars. Samples were collected from each dog 4 days prior to application of the collar (4 days prior to treatment or -4DAT) and 10 days after application of the collar (10DAT). In addition, at the end of the study, each collar used on the animals was collected, stored in separate containers, and sent to the analytical testing laboratory facility.

Fortification samples were prepared on -4DAT and 10DAT. Duplicate samples were fortified with each analyte at three levels: 120 µg/sample (LOQ), 2,000 µg/sample, and 4,400 µg/sample. Fortified samples were handled, stored and shipped in the same manner as the residue samples. Average recoveries for the low-, mid- and high-level fortified samples ranged from 87.3 – 114% for TCVP on sampling day 10 and from 82.5-105% for DCA.

Glove samples collected prior to the application (-4DAT) did not have any detectable residues and are not discussed herein. Versar corrected the 10-DAT field samples using the 10-DAT field fortification recoveries. Residues ≤660 µg were corrected for the average low level field fortification recovery (87.3% for TCVP and 82.5% for DCA); residues >2,800 µg were corrected for the average high level field fortification recovery (106% for TCVP and 100% for DCA); and residues between 600 µg and 2,800 µg were corrected for the average mid-level field fortification recovery (114% for TCVP and 105% for DCA). Versar calculated residues in µg/glove, µg/cm^2 of dog surface area, percent of initial TCVP in collar, and percent of applied dose transferred.

The difference between the initial collar weight and the end weight was multiplied by the percent active ingredient in the collar (14.55%) to calculate the actual dose applied. The actual dose applied ranged from 0.052 to 0.2639 g ai (51,914 to 268,622 µg ai). In addition, Versar calculated the initial TCVP in the collar by multiplying the percent active ingredient in the collar (14.55%) by the initial weight of the collar. The initial TCVP in the collar ranged from 2.52 to 3.05 g ai (2,524,192 to 3,048,429 µg ai).

The highest average residues of TCVP occurred on gloves after 20 petting simulations (Group 3) at 4,527.5 µg/gloves (5.98% of applied dose and 0.886 µg/cm^2). The lowest average residues of TCVP were observed on gloves from Group 2 (10 petting simulations) at 2,512.9 µg/gloves (1.53% of applied dose and 0.456 µg/cm^2). For DCA, average residues were highest on gloves from Group 3 (20 petting simulations) at 473.9 µg/gloves. The relative ratio of TCVP/DCA ranged from 7.0 to 14.5; the highest average ratio was observed in Group 2 at 12.9.

Percent transferable residues of TCVP based on the initial TCVP in the collar ranged from 0.049% to 0.228%; average percent transferable residues of TCVP were 0.098% for Group 1 (5 petting simulations), 0.086% for Group 2 (10 petting simulations), and 0.167% for Group 3 (25 petting simulations).

Percent transferable residues of applied TCVP dose ranged from 0.93% to 6.83%; average percent transferable residues of applied TCVP were 2.38% for Group 1 (5 petting simulations), 1.53% for Group 2 (10 petting simulations), and 5.98% for Group 3 (25 petting simulations).

The following issues of concern are noted:

- Laboratory fortification samples were not analyzed at all. Typically, laboratory fortification samples are performed with each sample run as a check against losses that occur during laboratory operations (extraction, cleanup, analytical measurement). However, field fortified samples were analysed concurrently with the field samples.

- The characteristics of the mannequin hand were not reported, such as type of plastic and surface area.

- The amount of pressure applied to the mannequin was reported as "medium," with no quantifiable measurement reported. The same sampler was used for all petting simulations according to the study protocol.

- No information was provided on the fate of the product once it is applied. The samples were analyzed for parent compound only (TCVP).

- Cotton gloves were used to the collect the samples. No absorbency data were presented to quantify the difference between cotton gloves and bare hands.

- The study was conducted using only one breed of dog.

- There was only one sampling interval after application of the collar.

- Storage stability was demonstrated by the analysis of field fortified samples handled, stored and shipped in the same manner as the residue samples. However, the length of storage prior to analysis was not reported for the field fortified samples or the residue samples.

- The Registrant did not correct residues for field fortification recoveries.

- Raw data from the analysis of the used collars collected at the Day 10 sampling event was not provided in the Study Report, so the values reported could not be verified.

COMPLIANCE: Signed and dated GLP, Quality Assurance, and Data Confidentiality statements were provided. The study sponsor waived claims of confidentiality within the scope of FIFRA Section 10(d) (1) (A), (B), or (C). The study sponsor and director stated that the study was conducted under EPA Good Laboratory Practice Standards (40 CFR part 160) with the following exceptions: the quality assurance unit did not conduct inspection or maintain records appropriate to the study; the commercial animal ration used in the study was not analyzed for specific contaminants because none were expected; and the drinking water used in the study was not analyzed for specific contaminants because none were expected.

CONCURRENT EXPOSURE STUDY: No

WAS AIR SAMPLING CONDUCTED IN CONJUNCTION WITH SURFACE SAMPLING? No

GUIDELINE OR PROTOCOL FOLLOWED: The study was designed according to the US EPA Standard Operating Procedures for Residential Pesticide Exposure Assessment. It was reviewed using using applicable parts of the OPPTS Test Guidelines Series 875, Occupational and Residential Exposure Test Guidelines, Group B: 875.2100 (dislodgeable foliar residue), 875.2300 (indoor surface residue) and 875.2400 (dermal exposure). The study was designed A compliance checklist is provided in Appendix A.

I. MATERIALS AND METHODS

A. MATERIALS

1. Test Material:

Active ingredient:	TCVP
Formulation:	Hartz® Ultra Guard Flea and Tick Collar for Dogs, containing a nominal 14.55% (wt/wt) TCVP.
Purity formulation:	14.86% (assayed October 18. 2018)
Lot # formulation:	PP26881 (Batch No. TS #14112)
CAS #(s):	22248-79-9
Other Relevant Information:	EPA Registration No. 2596-84.

2. Relevance of Test Material to Proposed Formulation(s):

The test material appears to be the same as the product described in the label for Hartz® Ultra Guard Flea and Tick Collar for Dogs (EPA Registration No. 2596-84), containing a nominal 14.55% (wt/wt) TCVP.

B. STUDY DESIGN

The study protocol (No. 2911), signed by the Study Director on January 2, 2019, was provided with the Study Report. There was one deviation from the protocol, involving the use of two gloves, instead of three, on Group 1 dog MC4776 during the Day 10 petting procedures.

1. Site Description:

Test location: The study was conducted at the BerTek, Inc. facility in Greenbrier, Arkansas. The animals were housed in individual indoor runs (5 ft. x 4 ft.), which were cleaned daily.

Meteorological Data: Not applicable. Testing was conducted indoors. According to the Study Report, artificial lighting was provided for approximately 12 hours, and temperature and ventilation were maintained by the facility HVAC system.

2. **Animal(s) Monitored:**

Species/Breed: Beagle or beagle mix dogs.

Number of animals in study: There were 9 dogs (5 male and 4 female) used in the study.

Age: The dogs were 4 to 6.5 years at dose administration.

Body weight: The dogs weighed 16.7 to 32.3 lbs at dose administration

Feeding: According to the Study Report, dogs were fed once daily, approximately 1-2 cups of commercial dry canine ration (Loyall, Adult Maintenance Formula, Nutrena). Water from the Greenbrier city water supply was provided ad libitum.

Health: All of the dogs were in good health; no ectoparasiticides had been administered within 8 months prior to Day 0. No clinical observations were noted in the dogs during the study period.

Surface characteristics: The dogs were bathed with a non-insecticidal shampoo (BioGuard, Farnam) and groomed seven days prior to the study. Hair density and texture were not reported. The Study Report also did not mention whether hair/skin observations were made.

Other products used: None

3. **Physical State of Formulation as Applied:**

The test substance was applied as an impregnated plastic collar.

4. **Application Rates and Regimes:**

Application rate(s): The test product (Hartz® Ultra Guard Flea and Tick Collar for Dogs) is a one size fits all collar. Each collar was weighed prior to securing on the dog. The collar was placed around the dog's neck, adjusted for proper fit and buckled in place. Once the collar was secured, the excess was cut off leaving approximately 2 inches of collar past the buckle as per label directions. The excess collar piece was weighed; the difference in the weight was referred to as the initial collar weight. At the end of the study, the collar was weighed again.

Application Regime: Each of the dogs was treated at the labeled rate. The collars were placed on the dogs as per label instructions. The collar was first weighed, unrolled, stretched to active, and then it was placed around the neck of the dog. The collar was secured using the attached buckle and the excess portion of the collar was removed. Two excess inches of the collar were left on in case an adjustment for fit was needed. The excess portion of the collar was weighed and measured and then discarded.

Application Equipment: The test substance was applied as an impregnated plastic collar around the dog's neck.

Human Safety: Research personnel wore disposable gloves and aprons while handling the collars and animals. Gloves and aprons were change between each dog.

5. Transferable Residue Sampling Procedures:

Method and Equipment: Three cotton gloves were placed on a mannequin hand. According to the study protocol, the cotton gloves were dye-free and 100% thin woven cotton. Two mannequin hands, one right and one left, were utilized without prejudice. The mannequin hands (Flexible Soft Fake Hand) were manufactured by HeroNeo. The same sampler was used for all petting simulations according to the study protocol.

Sampling Procedure(s): The researcher stroked the body surfaces of the dog with the mannequin hand with a uniform medium pressure and motions that ran with the lay of the hair coat. One petting simulation was comprised of three strokes beginning from the head and ending at the tail base. The three strokes included:

- One stroke on the left side (along the ribcage)
- One stroke on the back line, not avoiding the collar.
- One stroke on the right side (along the ribcage)

Petting motions were conducted using the palmar surface of the gloved mannequin hand, with splayed fingers. Excessive amounts of hair accumulating on the gloves due to the petting process were removed with care (after completion of the entire petting simulation).

Nine dogs were randomly assigned to three groups (3 dogs each). Each group had different assigned number of simulations. Dogs in Group 1 were petted for 5 simulations, dogs in Group 2 received 10 petting simulations, and dogs in Group 3 received 25 petting simulations.

The cotton gloves were removed one at a time by grasping the glove at the wrist and pulling the glove off the mannequin hand in such a manner as to not contaminate the glove. Each cotton glove sample was placed directly into separate pre-labeled glass jars, sealed tightly with a lid.

Surface area(s) sampled: The total surface area covered by the petting simulation scenario was not provided nor was the palmar surface area of the gloved hand performing the petting strokes.

Sampling Time: The length of time to complete a single stroke or the entire stroking procedure was not provided.

Replicates per surface:

- Replicates per sampling time: Nine dogs were sampled at each interval.
- Number of sampling times: There were a total of 2 sampling intervals, including one sampling event prior to application.

Times of sampling: Samples were collected 4 days prior to treatment (-4DAT) and 10 days after treatment (10DAT).

6. **Sample Handling:**

After the petting exercise, each glove sample was placed directly into separate glass jars, sealed tightly with a lid. At the end of the study, each collar used on the animals was collected, stored in separate containers, and sent to the analytical testing laboratory facility. Samples were shipped at ambient conditions by FedEx First Overnight to the analytical laboratory (Hartz Technical Center in Carlstadt, NJ). The length of storage of the field samples prior to analysis was not reported.

7. **Analytical Methodology:**

Extraction method(s): The glove samples were extracted using 50 mL of acetonitrile. Each sample was mixed on an automatic shaker for approximately 30 minutes. An aliquot of the extract was then analyzed by gas chromatography.

Samples of the pet collar from each dog were also analyzed. Samples were extracted with an acetone solution containing Dibutyl Phthalate (DBP), as an internal standard. Each sample was mixed on an automatic shaker for at least 2 hours. An aliquot of the extract was then analyzed by gas chromatography with flame ionization detection.

Detection method(s): Table 1 presents a summary of the typical operating conditions for the analysis of samples of cotton gloves and pet collars.

Table 1. Summary of Chromatographic Operating Conditions

Cotton gloves	
Column temperature:	230°C for 0.5 minute to 290°C for 1.0 minute at 35°C/min.
Detector Temperature:	275°C
Injector Temperature:	245°C
Injection Volume:	2.5 µL
Carrier (He) Flow Rate:	5 mL/min
Split Ratio:	5:0
Air Flow Rate:	400 mL/min
Hydrogen Flow Rate:	45 mL/min
Pet collars	
Column temperature:	280°C
Detector Temperature:	275°C
Injector Temperature:	250°C
Injection Volume:	1.0 µL
Carrier Flow Rate:	5 mL/min
Split Ratio:	10:1
Air Flow Rate:	400 mL/min
Hydrogen Flow Rate:	50 mL/min

Method validation: Residues of TCVP and DCA on cotton glove matrices were analyzed using Method TM #543-0 "Determinations of Rabon (Tetrachlorvinphos - TCVP) and

Dicapryl Adipate (DCA) in Glove Samples used in Pet Collar Transferability Studies." Residues of TCVP and DCA in pet collars were analyzed using Method TM #427-0 "Determination of Tetrachlorvinphos (Rabon), Dicapryl Adipate (DCA) and S-Methoprene in PVC Pet Collars by Gas Chromatography using a Capillary Column." Method validation was not discussed for either method.

For the cotton glove matrices, the limit of quantitation (LOQ) was reported to be 2.5 µg/mL, equivalent to 120 µg/glove based on a dilution factor of 50 required by sample preparation. The limit of detection was reported to be one half of the quantitation limit (LOQ) or 1.3 µg/mL, equivalent to 60 µg/glove based on a dilution factor of 50 required by the sample preparation.

For the pet collar matrices, the LOQ was not reported.

Instrument performance and calibration: For analysis of cotton glove matrices, a calibration curve was prepared by injecting constant volumes of calibration standard solutions. The calibration curve was created based on linear regression. According to the Study Report, the correlation coefficient for the standard calibration curves for both components should be 0.99 or higher.

Quantification: Quantitation of residues in cotton glove samples was achieved using an external calibration curve calculated by linear regression of instrument responses for the reference substances at multiple concentrations. Quantitation of residues in pet collar matrices was achieved by internal standard calibration.

8. <u>Quality Control</u>:

Lab Recovery: Concurrent laboratory fortified samples were not prepared. However, the stability/transport samples were analyzed concurrently with the field samples.

Field blanks: Field blanks were not used in the study.

Field recovery: Fortification samples were prepared four days prior to the application (-4DAT) and on Day 10 after treatment (10DAT). Duplicate samples were fortified with each analyte at three levels: 120 µg/sample (LOQ), 2,000 µg/sample, and 4,400 µg/sample. At each fortification event, cotton gloves were placed in glass jars and the fortification solution was added directly on each glove, followed by 50 mL of acetone. The sample bottle was sealed tightly and shaken using an automatic shaker for at least 30 minutes. Fortified samples were handled, stored and shipped in the same manner as the residue samples. Field fortification recoveries are summarized in Table 2.

Table 2. Field Fortification Recovery for TCVP and DCA							
Analyte	Interval	Fortification Level (µg/glove)	n	Recoveries (%)	Average Percent Recovery (%)		
					Low Level	Mid-Level	High Level
TCVP	-4DAT	120	2	78.2, 81.5	79.5	109	108
		2,000	2	107, 110			
		4,400	2	102, 113			
	10DAT	120	2	77.0, 97.5	87.3	114	106
		2,000	2	120, 109			
		4,400	2	104, 107			
DCA	-4DAT	120	2	98.8, 101	100	104	103
		2,000	2	103, 104			
		4,400	2	98.8, 107			
	10DAT	120	2	82.5, 146[1]	82.5	105	100
		2,000	2	105, 105			
		4,400	2	99.0, 100			

[1] Considered an outlier; not included in the calculation of average recovery.

Formulation: Hartz® Ultra Guard Flea and Tick Collar for Dogs, containing a nominal 14.55% (wt/wt) TCVP. According to the Certificate of Analysis, the test product contained 14.86% (wt/wt) TCVP.

Tank mix: Not applicable.

Travel Recovery: Travel recovery samples were not prepared.

Storage Stability: A separate storage stability study was not conducted. Storage stability was evaluated by the use of field fortified samples that were handled and shipped in the same manner as the residue samples. Overall average recoveries for these samples ranged 98.6-103% for TCVP and 98-102% for DCA.

II. RESULTS AND CALCULATIONS

Residue Transfer Gloves Analysis:
The Registrant reported the results in µg TCVP/glove and µg DCA/glove for the pre-collar application (-4DAT) and post-collar application (10DAT) sampling intervals without correction for fortification recoveries. Glove samples collected prior to the application (-4DAT) did not have any detectable residues and are not discussed herein. TCVP residue from the Day 10 cotton glove samples ranged from 1,285 to 5,827 µg; DCA residues from Day 10 cotton glove samples ranged from 176 to 504 µg. The Registrant calculated the percent transferable residues of TCVP using the average initial collar weight and the initial % TCVP in the collar (14.55%). Average % transferable residues of TCVP were 0.11% for Group 1 (5 petting simulations), 0.10% for Group 2 (10 petting simulations), and 0.17% for Group 3 (25 petting simulations).

Versar corrected the field samples using the 10-DAT field fortification recoveries. Residues ≤660 µg were corrected for the average low level field fortification recovery (87.3% for TCVP and 82.5% for DCA); residues >2,800 µg were corrected for the average high level field fortification recovery (106% for TCVP and 100% for DCA); and residues between 600 µg and 2,800 µg were corrected for the average

mid-level field fortification recovery (114% for TCVP and 105% for DCA). Versar calculated residues in µg/glove, µg/cm^2 of dog surface area, percent of initial TCVP in collar, and percent of applied dose transferred. The surface area of the dog was determined using the following equation:

$$\textit{Surface area of dog (cm}^2\textit{)} = (12.3*((\textit{animal body weight (lbs)}*454)^{0.65}))$$

The difference between the initial collar weight and the end weight was multiplied by the percent active ingredient in the collar (14.55%) to calculate the actual dose applied. The actual dose applied ranged from 0.052 to 0.2639 g ai (51,914 to 268,622 µg ai). In addition, Versar calculated the initial TCVP in the collar by multiplying the percent active ingredient in the collar (14.55%) by the initial weight of the collar. The initial TCVP in the collar ranged from 2.52 to 3.05 g ai (2,524,192 to 3,048,429 µg ai).

Measured residues (µg/gloves) detected in each glove sample (outer and inner cotton gloves) collected on 10DAT are shown in Table 3. Each sample consisted of three layers of cotton gloves on a mannequin hand. For all samples, the outermost glove contained most of the residue. The second glove contained little or no residue, and no detectable residues were found on the third glove. Table 3 also provides for each replicate the total gloved mannequin hand residues (outer cotton + two inner cotton gloves) in µg/gloves, percent of initial TCVP in collar, percent of applied dose transferred, and µg/cm^2 of dog surface area. Table 4 provides a summary (average and standard deviation) of these results for each group.

The highest average residues of TCVP occurred on gloves after 20 petting simulations (Group 3) at 4,527.5 µg/gloves (5.98% of applied dose and 0.886 µg/cm^2). The lowest average residues of TCVP were observed on gloves from Group 2 (10 petting simulations) at 2,512.9 µg/gloves (1.53% of applied dose and 0.456 µg/cm^2). For DCA (Table 5), average residues were highest on gloves from Group 3 (20 petting simulations) at 473.9 µg/gloves. The relative ratio of TCVP/DCA ranged from 7.0 to 14.5; the highest average ratio was observed in Group 2 at 12.9.

Percent transferable residues of TCVP based on the initial TCVP in the collar ranged 0.049% to 0.228%; average percent transferable residues of TCVP were 0.098% for Group 1 (5 petting simulations), 0.086% for Group 2 (10 petting simulations), and 0.167% for Group 3 (25 petting simulations).

Percent transferable residues of applied TCVP dose ranged 0.93% to 6.83%; average percent transferable residues of applied TCVP were 2.38% for Group 1 (5 petting simulations), 1.53% for Group 2 (10 petting simulations), and 5.98% for Group 3 (25 petting simulations).

Collar Analysis:
The Study Report also presented the results of the analysis of the used collars in percent of TCVP and percent of DCA after the test; the raw data from these analyses were not reported. According to Table 4 of the Study Report, the percent TCVP in the collars after the test ranged from 10.3% to 14.7%; the collar used on Group 3 dog MC4114 showed an increased in the % TCVP and was excluded from the analysis of the reduction of TCVP in the collar over the Day 10 sampling period. No explanation was provided in the Study Report regarding this finding. The percent loss of TCVP was reported to range from 1.4% to 4.2% (average of 3.09%).

III. DISCUSSION

A. LIMITATIONS OF THE STUDY:

The following issues of concern are noted:

- Laboratory fortification samples were not analyzed at all. Typically, laboratory fortification samples are performed with each sample run as a check against losses that occur during laboratory operations (extraction, cleanup, analytical measurement). However, field fortified samples were analysed concurrently with the field samples.

- The characteristics of the mannequin hand were not reported, such as type of plastic and surface area.

- The amount of pressure applied to the mannequin was reported as "medium," with no quantifiable measurement reported. The same sampler was used for all petting simulations according to the study protocol.

- No information was provided on the fate of the product once it is applied. The samples were analyzed for parent compound only (TCVP).

- Cotton gloves were used to the collect the samples. No absorbency data were presented to quantify the difference between cotton gloves and bare hands.

- The study was conducted using only one breed of dog.

- There was only one sampling interval after application of the collar.

- Storage stability was demonstrated by the analysis of field fortified samples handled, stored and shipped in the same manner as the residue samples. However, the length of storage prior to analysis was not reported for the field fortified samples or the residue samples.

- The Registrant did not correct residues for field fortification recoveries.

- Raw data from the analysis of the used collars collected at the Day 10 sampling event was not provided in the Study Report, so the values reported could not be verified.

B. CONCLUSIONS:

The Registrant and Versar calculated similar transferable residues. The slight difference is most likely due to Versar's use of ½ LOD for those values assayed at less than the LOD. The Registrant reported total residues as the sum of detectable residues on each glove. In addition, Versar corrected residues for field fortification recoveries; the Registrant did not correct the measured residues.

Table 3. TCVP Residues from Cotton Gloves Following Petting Simulations to Treated Dogs Ten Days After Treatment (10DAT)												
Group #	Animal #	Animal Weight (lbs)	Animal Surface Area (cm^2)	Initial TCVP in Collar[1] (µg ai)	Actual Dose Applied[2] (µg ai)	Measured Residue on Gloves – Corrected [3,4] (µg/glove)			Total Residue[5]		% of initial TCVP transferred[6]	% of applied dose transferred[7]
						Outer Cotton Glove #1	Inner Cotton Glove #2	Inner Cotton Glove #3	µg/gloves	µg/cm^2 surface area of dog		
1 (5 petting simulations)	MC1461	24.7	5275	2918526	149923	2796.6	<LOD	<LOD	2856.6	0.542	0.098	1.91
	MC4776	16.7	4090	2524192	108863	2823.5	164.8	---[8]	2988.3	0.731	0.118	2.75
	MC5608	28.8	5829	2831095	86645	1985.3	150.2	<LOD	2165.4	0.371	0.076	2.50
2 (10 petting simulations)	MC3326	23.9	5164	2830426	140218	3565.9	<LOD	<LOD	3625.9	0.702	0.128	2.59
	MC1052	32.3	6280	3048428	268622	2445.7	<LOD	<LOD	2505.7	0.399	0.082	0.93
	MC9343	24.9	5303	2881845	129596	1346.9	<LOD	<LOD	1406.9	0.265	0.049	1.09
3 (25 petting simulations)	MC4574	20.4	4659	2540531	84666	5571.5	184.4	<LOD	5785.9	1.24	0.228	6.83
	MC2938	26.6	5536	2819819	86805	4873.6	152.0	<LOD	5055.6	0.913	0.179	5.82
	MC4114	26.1	5468	2906828	51914	2680.8	<LOD	<LOD	2740.8	0.501	0.094	5.28

1. Initial TCVP is based on a 14.55% nominal concentration in the collar = initial weight of collar*0.1455
2. Applied Dose is based on a 14.55% of nominal collar application = (initial weight of collar minus weight of collar at end of study) * 0.1455
3. LOD = 60 µg/glove and LOQ = 120 µg/glove. When residues were reported as less than the LOD, Versar used a value of ½ LOD (60 µg/glove) in the calculations.
4. Residues were corrected for field fortification recoveries. Residues ≤660 µg were corrected for the average low level field fortification recovery (87.3%); residues >2,800 µg were corrected for the average high level field fortification recovery (106%); and residues between 600 µg and 2,800 µg were corrected for the average mid-level field fortification recovery (114%)
5. Total Residue (µg/gloves) = outer cotton glove #1 + inner glove #2 + inner glove #3 (µg/glove). Total Residue (µg/cm^2) = Total residue on all 3 gloves / cm^2 body surface area of the dog.
6. % of initial TCVP transferred = Residue (µg/sample) / initial TCVP in collar (µg ai) *100
7. % of applied dose transferred = Residue (µg/sample) / applied dose (µg ai) *100
8. Only two gloves were used on Group 1 dog MC4776 during the Day 10 petting procedures.

Table 4. Summary of TCVP Residues from Cotton Gloves Following Petting Simulations to Treated Dogs								
Group	Total Residue				% of initial TCVP transferred[a]		% of applied dose transferred[b]	
	µg/gloves		µg/cm² body surface area of dog					
	Average	Standard Deviation	Average	Standard Deviation	Average	Standard Deviation	Average	Standard Deviation
1 (5 petting simulations)	2670.1	442.0	0.548	0.180	0.098	0.021	2.38	0.43
2 (10 petting simulations)	2512.9	1109.5	0.456	0.224	0.086	0.040	1.53	0.91
3 (25 petting simulations)	4527.5	1589.8	0.886	0.371	0.167	0.068	5.98	0.79

Note: Totals represent sum of three cotton gloves

[a] % of initial TCVP transferred = total µg ai in all gloves of one dog / µg ai initial TCVP in collar

[b] % of applied dose transferred = total µg ai in all gloves of one dog / µg ai applied to the dog

Table 5. DCA Residues from Cotton Gloves Following Petting Simulations to Treated Dogs Ten Days After Treatment (10DAT)						
Group #	Animal #	Measured Residue on Gloves – Corrected [1,2] (µg/glove)			Total Residue[3] (µg/gloves)	Ratio TCVP/DCA[4]
		Outer Cotton Glove #1	Inner Cotton Glove #2	Inner Cotton Glove #3		
1 (5 petting simulations)	MC1461	346.9	<LOD	<LOD	406.9	7.0
	MC4776	176.0	<LOD	---[5]	206.0	14.5
	MC5608	184.2	<LOD	<LOD	244.2	8.9
2 (10 petting simulations)	MC3326	223.8	<LOD	<LOD	283.8	12.8
	MC1052	185.6	<LOD	<LOD	245.6	10.2
	MC9343	<LOD	<LOD	<LOD	90.0	15.6
3 (25 petting simulations)	MC4574	491.3	<LOD	<LOD	551.3	10.5
	MC2938	504.2	<LOD	<LOD	564.2	9.0
	MC4114	246.1	<LOD	<LOD	306.1	9.0

1. LOD = 60 µg/glove and LOQ = 120 µg/glove. When residues were reported as less than the LOD, Versar used a value of ½ LOD (60 µg/glove) in the calculations.
2. Residues were corrected for field fortification recoveries. Residues ≤660 µg were corrected for the average low level field fortification recovery (82.5%); residues >2,800 µg were corrected for the average high level field fortification recovery (100%); and residues between 600 µg and 2,800 µg were corrected for the average mid-level field fortification recovery (105%)
3. Total Residue (µg/gloves) = outer cotton glove #1 + inner glove #2 + inner glove #3 (µg/glove).
4. Ratio TCVP/DCA = TCVP Residue (µg/sample) / DCA Residue (µg/sample)
5. Only two gloves were used on Group 1 dog MC4776 during the Day 10 petting procedures.